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DIVERSITY OF SYRPHIDAE (DIPTERA) IN CENTRAL APPALACHIAN FORESTS

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Abstract.—Species richness and abundance of Syrphidae in the central Appalachian forests was sampled with Malaise traps from 1995 through 2001. Syrphids were identified from the George Washington National Forest, Virginia, and the Monongahela National Forest, West Virginia. Of the 131 species identified, Eristalinae were the most species rich subfamily making up 61% of the total richness (80); Syrphinae were the most abundant making up 66% (5,138) of the total sampled abundance; Microdontinae with 3% of the total richness (4) represented 8% (587) of the total sampled abundance.

Key Words: Syrphidae, central Appalachian forests, species richness, diversity

Syrphidae are one of the more diverse families of Diptera with nearly 6,000 species described worldwide; approximately 870 species in 88 genera occur in the Nearctic Region (Vockeroth and Thompson 1987). Adult syrphids rank second only to bees (Hymenoptera: Apoidea) as important flower-visiting and flower-pollinating insects (Larson et al. 2001). Syrphid larvae have highly diverse feeding habits (Duffield 1981, Maier 1982, Vockeroth and Thompson 1987, Rotheray 1993); Syrphinae include important predators of Homoptera and other soft bodied insects such as young caterpillars, Eristalinae are primarily saprophagous, with some exceptions including phytophagy, and predation within the Pipizini, and Microdontinae are predators on ant broods. In America north of Mexico, species recognition relies primarily on the more conspicuous adults, approximately 7% of which have their immature stages associated (Thompson 1990).

A project was initiated in 1995 to study the effects of biopesticide control of gypsy moth (*Lymantria dispar* (L.)) (Strazanac et al. 2003a, Strazanac and Butler 2005) on nontarget organisms. Pollinators were a part of the original study plan which included a defoliation treatment caused by gypsy moth. While gypsy moth was effectively removed due a pathogenic fungus, limiting defoliation, important pollinators, including syrphids, continued to be tallied. From the sampling of adult syrphids we determined their richness and abundance within the broadleaf-pine forests in the adjacent George Washington National Forest (GWNF) and Monongahela National Forest (MNF) in the central Appalachians.

Materials and Methods

Eighteen 200-ha study plots were located in the GWNF and the MNF (Strazanac et al. 2003a) (Fig. 1). The GWNF study plots were along the

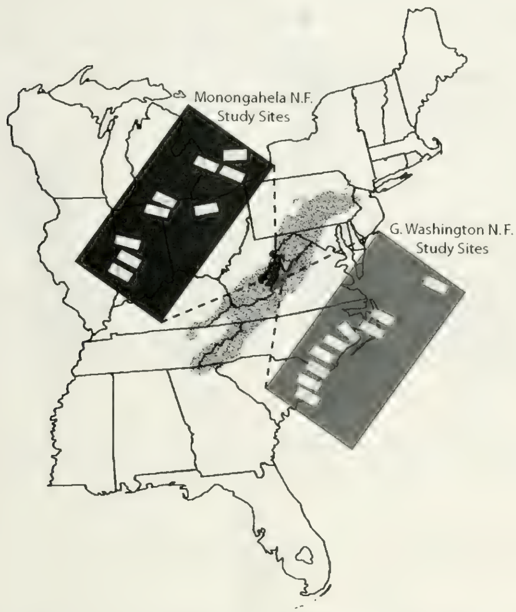

Fig. 1. Appalachian broadleaf-pine forests (after Keys et al. 1995) with study plot locations in the George Washington National Forest, Virginia, and in the Monongahela National Forest, West Virginia.

southeast slope of Great North Mountain in Augusta Co., VA, centered at 38°07′30″N, 79°22′30″W, with elevations of 561–744 m. The MNF study plots were in Pocahontas Co., WV, in groups of three on three different mountains, centered at 38°15′N, 80°00′W, with elevations of 805–1,232 m. Oaks (*Quercus* spp.) dominate both forest, but species of hickories (*Carya* spp.), pines (*Pinus* spp.) and maples (*Acer* spp.) are also abundant (Keys et al. 1995). A highly diverse understory of herbaceous plants (Strazanac et al. 2003a) dominates the forest floor in the spring until the deciduous canopy fully leafs out.

A randomly placed 30-ha subplot was established on each study plot. Two Townes-style Malaise traps (Townes 1972) were set up at different elevations on each subplot usually with one on a ridge and the other in a valley. Traps were placed on southerly-facing slopes or ridges, and the trap length oriented east–west with the collecting head up slope. Fifteen weekly samples were taken early May through mid-August from 1995 through 2001. Malaise sampled Syrphidae were sorted, tallied, and stored in 70% ethanol. Material was later pinned and processed through increasing concentrations of ethanol that was replaced with ethyl acetate before air drying. Syrphids from 1995 through 1999 (7,763) were fully processed and identified. Syrphidae from 2000 and 2001 (3,993) were tallied only.

Generic determinations were made by CJF and CBM using Vockeroth and Thompson (1987). Species-level identifications were facilitated for the authors (CJF, CBM) by F. C. Thompson and his compilation of keys to most eastern Syrphidae (unpublished). In addition, the works of the following authors were regularly referenced: Eristalinae, Coovert (1996), Coovert and Thompson (1977), Curran (1921); Microdontinae, Thompson (1981); and Syrphinae, Knutson (1973), Vockeroth (1980, 1983, 1986a, b, 1990, 1992). Species confirmations were made using the collection at the National Museum of Natural History, Smithsonian Institution, Washington, DC with the guidance of F. C. Thompson.

Voucher specimens are deposited in the West Virginia University Arthropod Collection, Morgantown, WV, and the National Museum of Natural History, Smithsonian Institution, Washington, DC.

Results and Discussion

From 1995 through 2001, a total of 11,756 Syrphidae were sampled in the GWNF and MNF. The relative trend in year to year abundance (Fig. 2) for the two forests were similar with the exception of years 1999 and 2001 when the sampled abundance was much greater in the MNF. In 1999 there were relatively large increases in abundance of *Syrphus*

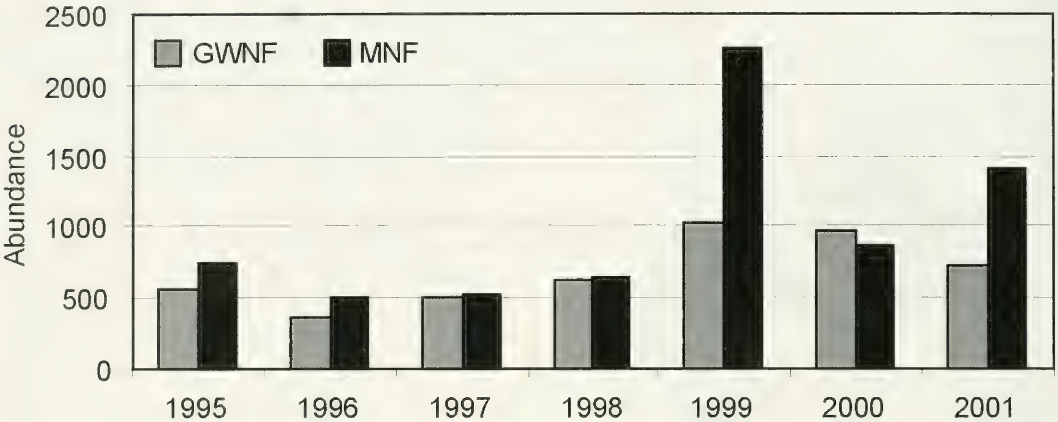

Fig. 2. Total sampled abundance of Syrphidae from 1995–2001 in the George Washington National Forest (GWNF), Virginia, and in the Monongahela National Forest (MNF), West Virginia.

species (Syrphinae) in both forests and *Microdon craigheadi* Walton (Microdontinae) in the GWNF (Fig. 3). Syrphidae for 2001 are unsorted so the relative increase of the group or groups involved are not known. Total abundance from 1995 through 1999 of Syrphinae in the GWNF and MNF combined was 66% compared with 26% for Eristalinae.

Representatives from 15 tribes (Vockeroth and Thompson 1987) were found in each forest (Table 1). The species-rich Syrphini (35), Milesiini (36), and Brachyopini (23) shared the greatest number of species between forests, 26, 22, and 17 respectively, while the remaining tribes are represented by 1 to 7 species most of which were shared between forests. Species richness was not a predictor of the relative sampled abundance within each tribe. Abundance (1,155) of Toxomerini with three species was exceeded only by Syrphini abundance (3,602) made up of 35 species. Milesiini abundance (618) was third followed by 4 species of Microdontini with a sampled abundance of 587. While Toxomerini and Microdontini have similar species richness, they represented different distributional patterns. Toxomerini species were widely distributed in both forest and in all the plots while Microdontini reached relatively high numbers in the GWNF only.

Eristalinae was the most species-rich subfamily in the GWNF and MNF combined, making up 61% of total richness. The more abundant Syrphinae made up 36% of the total species richness. Material identified through 1999 represents a total of 131 species: species richness was greater in the MNF with 118 species collected; 106 species were collected in the GWNF (Fig. 4). Distinct differences between study plots, such as, elevation, rainfall, and vegetation may influence the sampled richness. Other major taxa also had greater species diversity in the MNF compared to the GWNF plots. Five years (1995–1999) of Malaise sampled Symphyta (8,884 adults) produced 155 species (Strazanac et al. 2003b, Braud et al. 2003) with 127 species from the MNF and 104 from the GWNF. Similar species richness trends were also noted during this long-term study within the Lepidoptera (Butler et al. 2001) and Carabidae (Carrington 2002).

All sample years began with high abundance; species richness and total abundance generally peaked by the third week of sampling in the GWNF and the fourth week in the MNF. Most species were first collected in May (Table 2) and

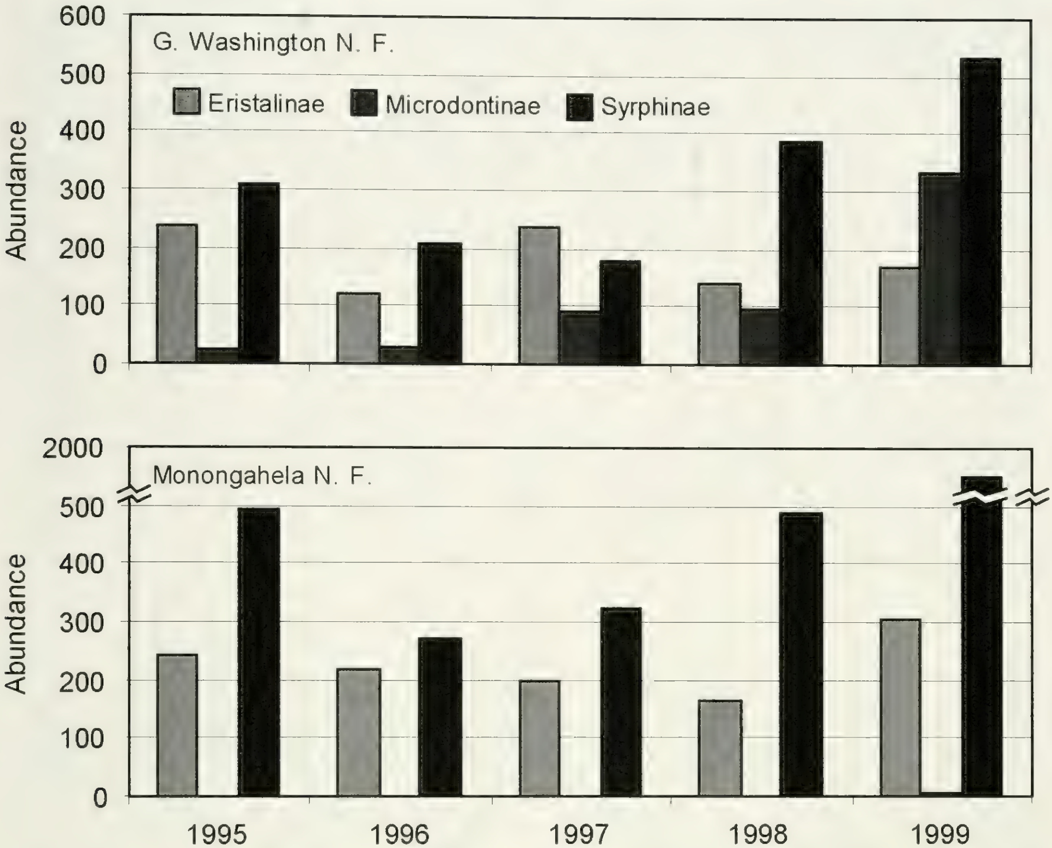

Fig. 3. Total sampled abundance of Syrphidae by subfamily from 1995–1999 in the George Washington National Forest, Virginia, and in the Monongahela National Forest, West Virginia.

those shared between forests typically first appeared in the GWNF one week earlier than in the MNF. Declines in counts of individual species started earlier in the GWNF, for example, *Syrphus torvus* Osten Sacken (Syrphinae) quickly declined in mid-May from the GWNF, then early June in the MNF. Seasonal occurrence and abundance for some species, including *Toxomerus geminatus* (Say) (Syrphinae), *Toxomerus marginatus* (Say), *Copestylum vesicularium* (Curran) (Eristalinae), and *Chrysotoxum derivatum* Walker (Syrphinae), were fairly consistent throughout the 15-week sampling period. The two more abundant *Microdon* species (Microdontinae) in the GWNF, *M. craigheadi* Walton and *M. tristis* Loew, had mostly non-overlapping adult flight periods. *Microdon tristis* was collected early in the season while *M. craigheadi* was most abundant during the last third of our sampling period. Within more abundant species, peaks in male abundance often occurred before peaks in female abundance (e.g., *M. craigheadi, Epistrophe nitidicollis* Meigen (Syrphinae), *Syrphus knabi* Shannon (Syrphinae)). Males were also typically collected during a shorter period as was especially evident in *Chalcosyrphus libo* (Walker) (Eristalinae), *Dasysyrphus venustus* (Meigen) (Syrphinae), and *Epistrophe emarginata* (Say) (Syrphinae).

Tables 1 and 2 are conservative in presenting species richness. Six specimens tentatively identified as *Eupeodes cana-*

Table 1. Sampled richness and abundance from 1995–1999 of Syrphidae by tribe in the George Washington National Forest (GWNF), Virginia, and in the Monongahela National Forest (MNF), West Virginia.

	Species Richness				Abundance		
Subfamily Tribe	GWNF	MNF	Total	Shared	GWNF	MNF	Total
Eristalinae							
Brachyopini	17	23	23	17	87	238	325
Callicerini	1	1	1	1	12	10	22
Cerioidini	1	1	1	1	16	3	19
Eristalini	2	3	3	2	10	20	30
Merodontini	1	1	1	1	22	4	26
Milesiini	29	29	36	22	275	343	618
Pipizini	6	6	6	6	106	269	375
Rhingiini	6	5	6	5	186	165	351
Sericomyiini	1	1	1	1	9	51	60
Volucellini	2	1	2	1	183	29	212
Microdontinae							
Microdontini	3	2	4	1	579	8	587
Syrphinae							
Bacchini	4	7	7	4	48	266	314
Paragini	2	2	2	2	49	18	67
Syrphini	28	34	35	26	995	2,607	3,602
Toxomerini	3	2	3	2	525	630	1,155

densis (Curran), *Eupeodes confertus* (Fluke) and *Eupeodes luniger* (Meigen) are tallied as *Eupeodes* sp. (Syrphinae). Characters used in species determinations for this group may be influenced by temperature differences experienced during the pupal stage (Dušek and Láska 1974). The following groups are taxonomically difficult, species differentiation is based on male genitalia and secondary sexual attributes: *Heringia* (Eristalinae), *Paragus* (*Paragus*) (Syrphinae), and *Platycheirus* (Syrphinae). These genera were identified as far as current literature permitted.

Species counts peaking in the early weeks of our annual sampling period may indicate that some taxa may be under-represented or missed. Sampling 29 April through 27 September 1991–1993, Cicero and Barrows (2000) collected *Criorhina nigriventris* Walton and *C. verbosa* Walker (Eristalinae: Milesiini) in Malaise traps in a similar Appalachian habitat at a more northern latitude. These species were sampled during the first few weeks ending in mid-May, approximately the time our sampling started. *Criorhina* was not sampled in our survey.

Based on the five years of identified material, species accumulation may be approaching an asymptote in both the GWNF and MNF (Fig. 5). If true, the MNF does have a richer fauna with 118 species compared to GWNF's 106 species. Chao estimators (Colwell 1997) suggest the two forests may ultimately prove to be more similar and species rich. Chao 1 and Chao 2 predict GWNF to

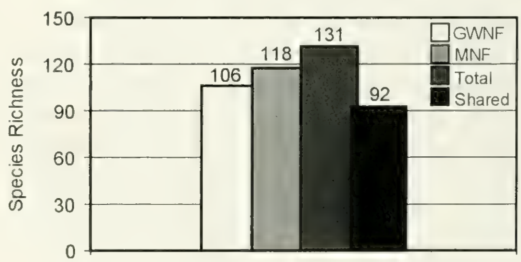

Fig. 4. Species richness of Syrphidae from 1995–1999 in the George Washington National Forest (GWNF), Virginia, and in the Monongahela National Forest (MNF), West Virginia.

Table 2. Sampled richness and abundance of Syrphidae from 1995–1999 in the George Washington National Forest (GWNF), Virginia, and in the Monongahela National Forest (MNF), West Virginia. Flight period dates are last day of 7-day sampling periods. Jun = June, Jul = July, Aug = August. N = number.

Subfamily	G. Washington N. F.				Monongahela N. F.			
Tribe	Males		Females		Males		Females	
Species	Flight Period	N	Flight Period	N	Flight Period	N	Flight Period	N
ERISTALINAE								
Brachyopini								
Brachyopa daeckei Johnson	May 13–26	4	May 20–29	5	May 17–26	7	May 18–27	4
Brachyopa flavescens Shannon	May 8–20	6	May 10–Jun 16	8	May 17–Jun 12	12	May 10–Jun 23	8
Brachyopa notata Osten Sacken	Jun 2	1			May 10–Jun 30	5	May 10–Jul 5	4
Brachyopa perplexa Curran					May 18–Jun 14	4	May 31–Jun 14	4
Brachyopa vacua Osten Sacken					May 10	1	May 18	1
Chrysogaster antitheus Walker	May 20	1	May 27	1	May 27	2	May 15–Jun 23	7
Myolepta nigra Loew			May 18–Jun 26	8			Jun 12–19	2
Myolepta strigilata Loew	May 5–19	2	May 12–26	6			May 10	1
Myolepta varipes Loew	May 27–Jun 7	2	May 12–Jul 6	12	May 25	1	May 27–Jun 30	6
Neoascia globosa (Walker)					May 17	1		
Neoascia metallica (Williston)							May 10–18	2
Orthonevra nitida (Weidemann)	May 26	1					May 19–29	3
Sphegina appalachiensis Coovert					May 20	1	May 27–Jun 29	4
Sphegina biannulata Malloch			Jun 22–29	2	Jul 21	1	Jun 29	1
Sphegina brachygaster Hull	May 15	1			May 10–15	2	May 6–26	11
Sphegina campanulata Robertson	May 22–Jul 5	3	May 18–Jul 14	10	May 25–Jul 3	7	May 20–Jul 19	25
Sphegina flavimana Malloch	Jun 15	1	Jun 19–Jul 7	3	May 15–29	4	Jul 7–Aug 10	6
Sphegina flavomaculata Malloch			Jun 16	1	May 5–29	16	May 12–Jun 9	5
Sphegina keeniana Williston	Jun 16	1			May 18–Jun 14	5	May 5–Jul 7	15
Sphegina lobata Loew					May 29	1		
Sphegina lobulifera Malloch			May 15	1	May 5	1	May 22–Jun 5	4
Sphegina petiolata Coquillett	May 11–Jun 26	3	Jun 26–Jul 17	3	May 25–Jul 26	22	May 18–Jul 21	29
Sphegina rufiventris Loew			May 11	1	May 18–26	2	May 13	1
Callicerini								
Callicera erratica (Walker)			May 5–18	12	May 5–27	6	May 10–29	4
Cerioidini								
Ceriana willistoni (Kahl)	May 20–25	2	May 13–Jun 23	14	May 27	1	May 31–Jun 16	2

Table 2. Continued.

Subfamily / Tribe / Species	G. Washington N. F.				Monongahela N. F.			
	Males		Females		Males		Females	
	Flight Period	N	Flight Period	N	Flight Period	N	Flight Period	N
Eristalini								
Eristalis transversus Wiedemann							May 13–Jul 3	3
Helophilus fasciatus Walker	May 8	2			May 8–20	2	May 8–13	2
Mallota posticata (F.)	May 26	1	May 15–Jul 1	7			May 29–Jul 5	13
Merodontini								
Psilota flavidipennis Macquart	May 10	1	May 5–29	21	May 17	1	May 8–29	3
Milesiini								
Blera analis (Macquart)	Jun 14–22	2						
Blera badia (Walker)	May 18–Jun 7	3	May 22–Jun 30	7	Jun 23	1	Jun 16–Jul 7	6
Blera pictipes (Bigot)					May 17–Jun 23	4		
Blera umbratilis (Williston)	May 12	1	May 22–25	2	May 18–26	3	May 24–25	2
Brachypalpus oarus (Walker)	May 6–8	3	May 5–Jun 8	9	May 5–18	5	May 6–Jun 2	8
Chalcosyrphus anthreas (Walker)					Jun 8	1	May 17	1
Chalcosyrphus aristatus (Johnson)	Jun 7	1						
Chalcosyrphus chalybeus (Wiedemann)	May 17	1	Jul 7–28	2			May 25	1
Chalcosyrphus inarmatus (Hunter)	May 13–Jun 2	5	May 12–29	2	May 5–Jun 23	4	May 31–Jun 30	3
Chalcosyrphus libo (Walker)	May 6–Jun 14	9	May 6–Jul 3	21	May 5–Jun 17	18	May 5–Jul 21	26
Chalcosyrphus nemorum (F.)							Jul 26–Aug 2	2
Chalcosyrphus piger (F.)	May 10–Aug 5	8	May 12–Jun 30	5	May 18–Aug 12	27	Jun 16–Aug 16	3
Chalcosyrphus plesia (Curran)					Jun 14–26	3		
Chalcosyrphus vecors (Osten Sacken)					May 17	1	May 31	1
Hadromyia aepalius (Walker)	May 10–29	4	May 26	1				
Lejota aerea (Loew)	May 6–20	4	May 5–Jun 5	21	May 5–22	7	May 8–29	20
Milesia virginiensis (Drury)	Jun 22–Aug 14	8	Jul 7–Aug 11	4			Jul 29	1
Pterallastes thoracicus Loew	Jul 10	1	Jun 23–Jul 17	3	Jun 30–Aug 2	2		
Somula decora Macquart			May 22–Jun 12	5	May 10–29	2	May 29–Jun 17	4
Sphecomyia vittata (Wiedemann)	May 12–15	2	May 12–Jun 12	5			May 29–Jun 7	2
Spilomyia alcimus (Walker)			Jun 26	1				
Spilomyia fusca Loew	Jul 3	1	Jul 13–31	5			Jul 5–Aug 11	19
Temnostoma alternans Loew					Jun 7–Jul 7	11	Jun 7–Jul 21	9
Temnostoma balyras (Walker)	May 29–Jun 23	9	May 24–Jul 7	10	May 25–Jul 5	19	May 18–Jul 21	29

Table 2. Continued.

Subfamily / Tribe / Species	G. Washington N. F.				Monongahela N. F.			
	Males		Females		Males		Females	
	Flight Period	N	Flight Period	N	Flight Period	N	Flight Period	N
Temnostoma barberi Curran			May 22–Jun 8	3	Jun 8–14	2	Jun 7–14	2
Temnostoma trifasciatum Robertson	Jun 1–30	9	Jun 1–30	16	Jun 1–15	4		
Temnostoma vespiforme (L.)					Jun 7–Jul 21	9	Jun 14–Jul 10	4
Teuchocnemis lituratus (Loew)	May 10–Jun 26	21	May 10–Jun 12	18	May 10–Jun 30	36	May 18–Jun 30	15
Xylota angustiventris Loew	Jul 7	1						
Xylota bicolor Loew	Jun 19–29	3	Jun 14–Jul 28	4	Jul 21	1		
Xylota confusa Shannon			May 8–Jun 28	11			May 13–Jul 21	5
Xylota ejuncida Say			May 15–Aug 3	3				
Xylota hinei (Curran)			Jun 30	1	Jul 26	1	Jun 29–Jul 26	2
Xylota quadrimaculata Loew	Jul 7	1	May 20–Jul 6	9	May 27–Jun 30	3	May 29–Jul 31	10
Xylota sp.	May 6–Jun 16	8	Jun 23–30	2	May 13–31	4		
Pipizini								
Heringia salax (Loew)					May 27	1		
Heringia (Heringia) spp.	May 10–Jun 15	8			May 10–29	7		
Heringia (Neocnemodon) spp.	May 6–Aug 17	11			May 8–Jun 1	42		
Heringia spp.			May 8–Aug 17	66			May 10–Aug 17	46
Pipiza femoralis Loew	May 8	1			May 10–18	6	May 13	1
Pipiza nigripilosa Williston	May 8–24	11	May 6–10	2	May 8–31	92	May 10–Jun 10	65
Pipiza puella Williston			Jul 6–20	4			Jul 12	1
Trichopsomyia apisaon Walker	May 15	1	May 24	1	May 10–18	3	May 17–Jun 23	2
Trichopsomyia sp.			Jun 19	1			May 20	3
Rhingiini								
Cheilosia capillata Loew	May 15	1	May 8–Jun 7	7	May 8–19	8	May 6–29	18
Cheilosia pallipes Loew	Jul 20–Aug 17	3			Jul 1–Aug 10	3		
Cheilosia tristis Loew			Jun 14–30	5			Jun 19–Jul 3	2
Cheilosia sp.	Jun 14	1	Jul 3–Aug 11	14			Jul 3–Aug 12	20
Ferdinandea buccata (Loew)	May 5–Aug 16	15	May 5–Aug 17	138	May 5–Jun 19	15	May 5–Aug 7	66
Rhingia nasica Say	May 15	1	Jul 28	1	May 5–Aug 7	21	May 19–Aug 5	12
Sericomyiini								
Sericomyia chrysotoxoides Macquart			May 6–Jun 24	9	May 13–Jun 1	3	May 5–Jul 28	48

Table 2. Continued.

Subfamily	G. Washington N. F.				Monongahela N. F.			
Tribe	Males		Females		Males		Females	
Species	Flight Period	N	Flight Period	N	Flight Period	N	Flight Period	N
Volucellini								
Copestylum vesicularium (Curran)	May 18–Aug 14	46	May 18–Aug 14	129	May 25–Aug 2	12	Jun 12–Aug 12	17
Volucella bombylans (L.)	Jun 14	1	May 31–Jul 6	7				
MICRODONTINAE								
Microdontini								
Microdon baliopterus Loew	Jul 24	2						
Microdon craigheadii Walton	Jun 29–Aug 17	467	Jul 5–Aug 12	94				
Microdon megalogaster Snow							Jun 19–30	2
Microdon tristis Loew	May 29–Jun 5	5	May 22–Jun 26	11			May 24–Jul 7	6
SYRPHINAE								
Bacchini								
Baccha elongata (F.)	May 6–Jul 3	6	May 13–Jul 6	7	May 10–Aug 7	21	May 10–Jul 26	11
Melanostoma mellinum (L.)	May 8–Jul 24	7	Jun 15–Aug 11	7	May 5–Aug 17	52	May 5–Aug 11	36
Platycheirus hyperboreus (Staeger)	May 10–Aug 2	8			May 5–26	20		
Platycheirus immarginatus (Zetterstedt)					May 27	1		
Platycheirus nearcticus Vockeroth					May 18–Jun 16	10	May 29	1
Platycheirus obscurus (Say)	May 24–Jun 15	3	May 6–11	3	May 8–Jul 24	24	May 6–Aug 5	35
Platycheirus quadratus (Say)					Jun 3	1		
Platycheirus spp.			May 8–Jul 31	7			May 5–Aug 10	54
Paragini								
Paragus angustifrons Loew	Jul 12	1						
Paragus haemorrhous Meigen	May 25–Aug 10	16	May 11–Aug 17	32	May 8–Jun 17	4	May 10–Aug 11	13
Paragus (Paragus) sp.			Aug 3	1			May 18	1
Syrphini								
Allograpta obliqua (Say)	Jun 1–Jul 12	2	May 17–Jun 8	3	Jul 5	1	May 20–Jun 29	4
Chrysotoxum derivatum Walker	May 6–Aug 16	30	May 5–Aug 17	40	May 17–Aug 12	6	May 24–Aug 12	12
Chrysotoxum sp.			May 10–Jun 22	2	Jun 3	1	Jun 17	1
Dasysyrphus pauxillus (Williston)					May 8	1	May 8–29	6
Dasysyrphus venustus (Meigen)	May 8–15	7	May 5–Jun 5	54	May 8–27	138	May 8–Jun 10	142
Didea fuscipes Loew	May 19–Jul 24	2	Jun 1–Aug 12	9	May 15–Jul 10	4	May 8–Aug 11	6

Table 2. Continued.

Subfamily	G. Washington N. F.				Monongahela N. F.			
Tribe	Males		Females		Males		Females	
Species	Flight Period	N	Flight Period	N	Flight Period	N	Flight Period	N
Doros aequalis Loew			May 15–Jul 15	4			May 22	1
Epistrophe emarginata (Say)	May 6–10	3	May 6–Aug 3	36	May 10–20	6	May 6–Aug 11	38
Epistrophe grossulariae (Meigen)	Aug 7	1	Jul 5–24	3	Jul 17–Aug 16	7	Jul 19–Aug 14	5
Epistrophe metcalfi (Fluke)			May 8–Jun 14	9			May 29–Jun 1	2
Epistrophe nitidicollis (Meigen)	May 5–10	10	May 5–Jun 5	73	May 6–27	27	May 8–Jul 21	127
Epistrophe xanthostoma (Williston)	May 8–10	2	May 10–Jun 1	4	May 11–29	5	May 18–Jun 16	17
Eupeodes americanus (Wiedemann)	May 8–Jun 19	20	May 5–Aug 16	48	May 6–Jun 7	234	May 5–Aug 17	133
Eupeodes perplexus (Osburn)	May 10	1					May 17–24	2
Eupeodes vinelandi (Curran)	May 8–15	4	May 8–Aug 4	28	May 8–Jun 10	11	May 6–Aug 10	43
Eupeodes sp.	May 10	2			May 8–10	2	May 10–22	4
Leucozona xylotoides (Johnson)							Jun 19–26	2
Melangyna fisherii (Walton)							May 31	1
Melangyna lasiophthalma (Zetterstedt)			May 13	1	May 6	1	May 6–27	56
Melangyna triangulifera (Zetterstedt)			May 10–Jun 12	23			May 18–Jun 17	13
Meliscaeva cinctella (Zetterstedt)	May 8	1	May 8–Jul 10	5	May 5–Jun 29	47	May 6–Aug 14	64
Ocyptamus costatus (Say)					Aug 4	1		
Ocyptamus fascipennis (Wiedemann)			Jul 20	1				
Ocyptamus fuscipennis (Say)			May 25–Aug 17	8	Aug 10	1	Jun 28–Aug 14	6
Parasyrphus genualis (Williston)					May 8–22	6		
Parasyrphus melanderi (Curran)							May 15	1
Sphaerophoria contigua Macquart	May 5–Jun 30	3	May 8–Jun 22	10	May 15–Jun 1	4	May 10–Jun 23	8
Sphaerophoria sp.			Aug 3	1			May 15	1
Syrphus knabi Shannon	May 6–Jul 10	15	May 6–Aug 17	85	May 5–Jul 26	18	May 10–Aug 17	52
Syrphus rectus Osten Sacken	May 6–Jul 5	147	May 5–Jun 29	169	May 8–Aug 11	433	May 8–Aug 16	317
Syrphus ribesii (L.)	May 10–Jun 14	3	May 8–25	25	May 8–19	17	May 8–Jun 29	50
Syrphus torvus Osten Sacken	May 5–17	47	May 5–17	20	May 5–Jun 8	285	May 5–Jun 22	215
Xanthogramma flavipes (Loew)	May 19–Jun 29	4	May 22–Aug 17	30			May 22–Aug 11	26
Toxomerini								
Toxomerus geminatus (Say)	May 5–Aug 17	199	May 5–Aug 17	281	May 5–Aug 17	137	May 5–Aug 17	434
Toxomerus marginatus (Say)	May 10–Aug 14	14	May 18–Aug 5	29	May 5–Jul 8	21	May 6–Aug 16	38
Toxomerus politus (Say)	Jul 5	1	Jul 31	1				

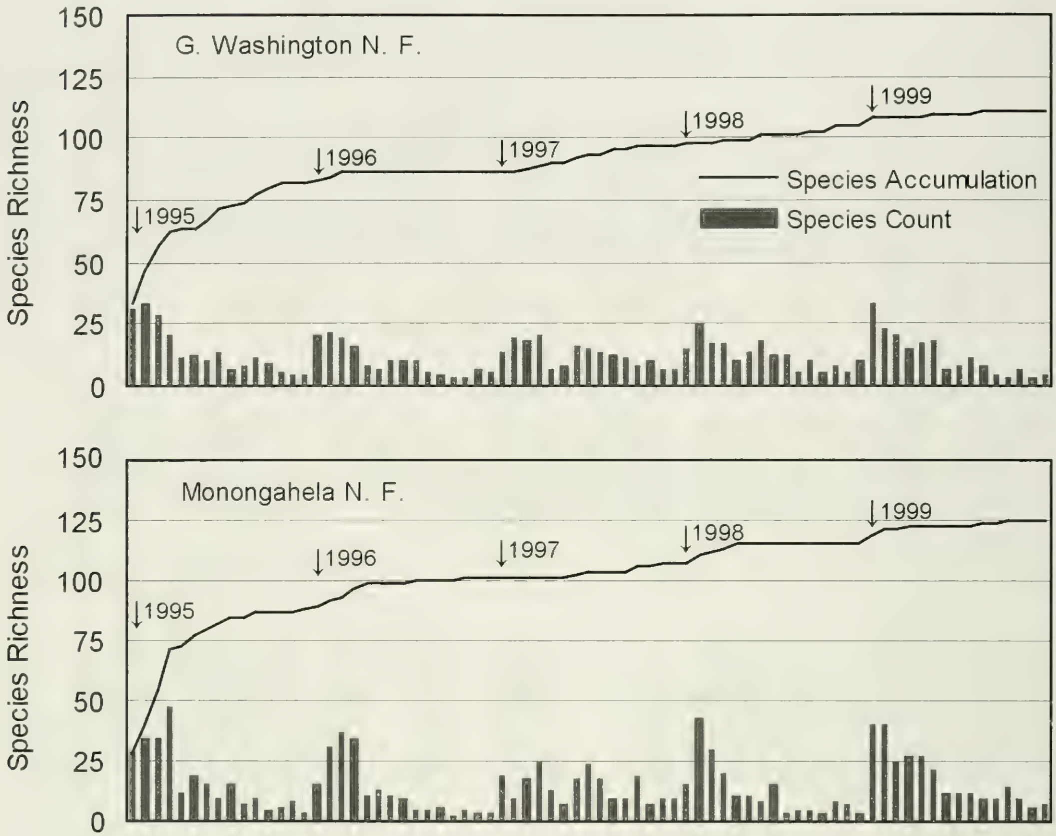

Fig. 5. Species accumulation and weekly counts of Syrphidae from 1995–1999 in the George Washington National Forest, Virginia, and in the Monongahela National Forest, West Virginia.

have 136 to 142 species, and MNF to have 142 to 149 species.

Few regional studies have been published of North American syrphid fauna. This is the first long-term study of syrphid richness within the central Appalachians forest considered one of the "Hot Spots" of diversity in North America (Chaplin et al. 2000). During our 15-week study periods, we ultimately sampled 15% of the Nearctic species in 62% of the genera known from this region. With additional collecting techniques and an extended sampling period the documented diversity will no doubt increase. Speciose taxa, such as syrphids that have very diverse life histories, underscore the importance of long-term intensive studies to sample their richness and seasonal abundance adequately, and to understand their role in forests fully.

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